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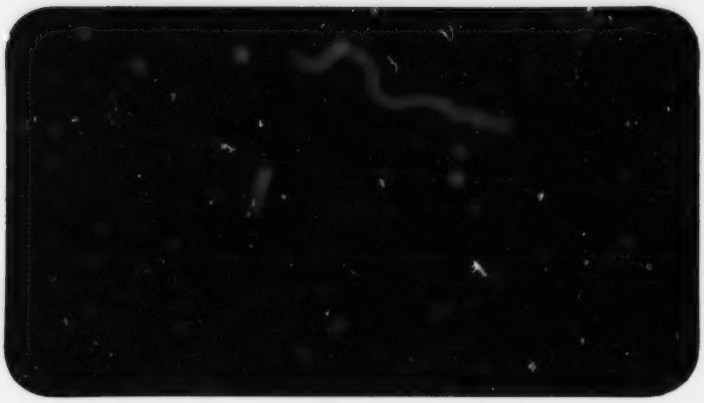
MANITOBA HAZARDOUS WASTE MANAGEMENT CORPORATION

Corporate Profile The Manitoba Hazardous Waste Management Corporation is a commercial Crown corporation established to develop and operate a hazardous waste management system for Manitoba. Its mandate is to provide for the handling of regulated hazardous wastes from their source through to their treatment and disposal, consistent with high standards of public health, safety and environmental quality.



Environmental Policy Statement

The Manitoba Hazardous Waste Management Corporation is committed to the preservation and enhancement of environmental quality through the development of a hazardous waste management system for the province. This undertaking is a fundamental element needed to achieve the broader objectives of universal environmental stewardship and sustainable economic development within Manitoba.

To reach these goals, the Corporation uses the following policy objectives as the basis for the performance of its work.

- Minimize waste generation and maximize resource conservation through the promotion and facilitation of waste reduction, recycling, re-use and recovery at source.
- Ensure that all activities involved with the handling, storage, treatment and disposal of waste and residue products are consistent with the protection of public health and environmental quality.
- Earn public approval of the system and its components through open and responsive communication and through public participation in all aspects of their development and operation.
- Encourage economic development through the provision of a cost-effective waste management system and the enhancement of environmentally based enterprises.
- Foster and promote contemporary environmental values and policies through public education and research, as well as by example.
- Assume, in perpetuity, the environmental stewardship of wastes and residues placed in the Corporation's custody.

Information regarding the activities and programs of the
Manitoba Hazardous Waste Management Corporation can be obtained from:
226-530 Century Street, Winnipeg, Manitoba R3H 0Y4
Telephone: (204) 945-1844 Toll Free: 1-800-782-2474 In Manitoba

91-03937/

PILOT PESTICIDE CONTAINER AND RESIDUE MANAGEMENT PROJECT

E. J. Yee and W. Omiucke

The Manitoba Hazardous Waste Management Corporation

September, 1989

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EXECUTIVE SUMMARY

This report describes a pilot project initiated by the Manitoba Hazardous Waste Management Corporation related to developing a comprehensive management capability for pesticide containers and residues. The purpose of this work is to evaluate various procedures and techniques that could be further developed to provide a complete and cost effective commercial service to address this particular problem in compliance with present regulatory standards.

A relatively small rural collection site containing 1400 metal and 2100 plastic containers was selected in the R. M. of Rossburn for the pilot project. A management process was developed based on the following assumptions:

1. The scope is a comprehensive solution where all containers and the resultant solid and hazardous waste components are managed in an environmentally sound manner.

2. Unrinsed containers are considered regulated hazardous waste and are unsuitable for conventional solid waste management or recycling.

3. Solid waste recycling would be maximized to the extent practical, as dictated by markets and acceptability of the material to resource recovery outlets.

4. Landfill disposal of uncontaminated or decontaminated solid waste can be used conditional on only Class 1 facilities (where only burial without burning is permitted) be used, volume reduction is maximized and appropriate provincial and municipal approvals being available.

The management of the 2100 plastic containers resulted in the collection of 103 liters of residue and 615 liters of rinsate. 512 liters of residue and 1435 liters of rinsate were collected from the management of the 1400 metal containers. The levels of selected pesticides identified in the metal container rinsate were significantly higher than those of the plastic container rinsate. Leachate testing of cardboard and both rinsed and unrinsed shredded plastic containers resulted in low to negligible levels of pesticides. Based on these results, the following conclusions were made:

1. The management and operational efficiency of a pesticide container and residue management program can be improved with the segregation of plastic and metal containers through the proper design and operation of collection sites, and educational programs.

2. The majority of containers deposited at the collection site are intact (not punctured) and capped. Residues from unrinsed containers will remain in the containers.

3. Significant quantities of pesticide residues are retained in the deposited containers, indicating that a residue draining step will be required in any management program

4. Metal containers retain significantly more residue per container than plastic containers (7.5 X), reflecting the better draining characteristics and a greater frequency of triple rinsing by the users for plastic containers.

5. Although pesticide residue levels remaining in drained plastic containers are low, both plastic and metal containers should be rinsed to provide assurance of decontamination and access to solid waste management options. This may cost effectively be accomplished through the use of a pressurized rinsing system. Rinsate from the plastic containers may be recirculated to reduce the volume of rinsate waste requiring treatment.

6. As is the case for residues, rinsing of metal containers generates significantly more rinsate (3.5 X) requiring management as a liquid hazardous waste than plastic containers.

7. Both the metal and plastic containers should be acceptable to the regulatory authorities as non-hazardous waste after draining and rinsing.

8. Metal containers should be crushed or shredded and are locally acceptable for recycling. Plastic containers should be shredded and transported to a Class 1 landfill for burial until an economically viable resource recovery option is available.

9. Cardboard containers do not retain sufficient levels of pesticide residues to be considered as hazardous waste. These materials may be managed as solid wastes.

10. There is potential for the development of specialized equipment to improve operational efficiency and reduce operating costs.

Based on the above conclusions, the following recommendations should be considered in the development of a pesticide container and residue management program.

1. Collection depots should be designed and operated in a manner that would encourage the segregation of metal, plastic and cardboard containers.

2. An educational program should be undertaken to encourage pesticide users to triple rinse containers, deliver intact and capped containers to collection depots and segregate containers.

3. All containers should be drained and rinsed to provide a sufficient level of decontamination to facilitate their designation by regulatory authorities as non-hazardous. Unrinsed containers should be regulated as hazardous waste.

4. Standards for collection depots, container decontamination, and management of decontaminated containers should be developed.

5. Metal containers should be recycled and plastic containers should be buried at Class 1 landfills until alternative resource recovery options become available.

6. The inherent higher residue and rinsate generation resulting from proper management of metal containers relative to plastic containers, coupled with the significant proportion that disposal costs will contribute to overall program costs (60%), suggest that the current practice of applying a common surcharge on both types of containers should be reviewed.

7. Research on plastic container design, recycling and reuse should be conducted.

8. Specialized equipment should be developed to improve the efficiency of the draining, rinsing and processing of the containers.

1.0 INTRODUCTION

This report describes a pilot project initiated by the Manitoba Hazardous Waste Management Corporation related to the comprehensive management of pesticide containers and residues. The purpose of this work is to evaluate various procedures and techniques that could be further developed to provide a complete and cost effective commercial service to address this particular problem. This information should be of use to various groups such as public policy makers, agricultural organizations, municipal governments and manufacturers in formulating action plans to address this issue. The results are also intended to provide support for the necessary regulatory approvals required to undertake such work and as a basis for the Corporation to offer commercial services in this area.

2.0 BACKGROUND

Empty pesticide containers are a highly visual pollution problem in agricultural areas such as rural Manitoba. The actual containers in which chemical pesticides are packaged are a solid waste and pesticide residues within unrinsed containers constitute a hazardous waste. In fact, the enforcement of current regulatory standards in most Canadian and American jurisdictions would result in consideration of unrinsed containers, when accumulated in quantity as a regulated hazardous waste.

Unrinsed containers pollute the environment through soil and ground water contamination and threaten the health of humans and animals directly exposed to toxic residues. Current disposal practices including burning and burial in municipal landfills is not viewed as being environmentally acceptable and poses potential health risks to the local community. The burning of containers is currently being discouraged by the Department of Environment, Department of Agriculture and the Crop Protection Institute of Canada. Many unknown emissions are produced from low temperature incineration of residual chemicals remaining in containers. Research has shown that at least four hazardous gases (chlorine, hydrogen chloride, hydrogen sulfide and nitric acid) are produced by burning some rather common pesticides at 900 degrees celsius (Kennedy et al, 1972).

Initial recognition of the issue occurred in Manitoba in 1982 when, the Environmental Management Division of the Department of Environment undertook a study in South-Central Manitoba to assess the problems associated with the disposal of an estimated 500,000 metal pesticide containers and examine alternative solutions to these problems (Environmental Management Services, 1982). The following observations and findings were made from this study:

- The pesticide container problem was of sufficient size to warrant continual attention through some sort of disposal program.
- Municipalities appear willing to co-operate in finding a resolution to this problem.
- Farmers are willing to take their empty containers to the waste disposal ground.
- Farmers do not sort the metal from the plastic containers and other garbage they deliver to the waste disposal ground. It is important to request municipalities to adequately post notices requesting farmers to separate garbage and plastic containers from metal ones.

- The recycling of metal containers is an acceptable disposal alternative from a workplace safety and health perspective provided the containers are shredded and further investigation of residues is conducted on the waste at the shredding mill.

- Portable crushers are effective although the process is slow and labour intensive. Crushers designed with puncture mechanisms prior to crushing effectively drain containers of liquid residues.

- Although a major undertaking with economic implications, a program can be designed to resolve the problem on a province wide basis.

- Educational efforts to persuade the users to triple rinse containers is not effective. It was estimated that 50% of the containers were not rinsed. Although the design of the plastic containers is such that they can be efficiently rinsed, and effectively drained even from a thirty second inversion, it was apparent that neither of these emptying techniques were extensively used.

- The disposal of residues will be a major and costly undertaking. It was determined by this study that as many as 6,500 liters of residual pesticide formulation require disposal each year in Manitoba.

- While it was suggested that fenced compounds be used for the deposit of containers, in many circumstances, it was found that they were unnecessary and cumbersome. The ideal locations had a special area set aside, away and preferably upwind of the waste disposal ground and well marked.

- Only 20% of the collected containers were plastic in 1982, but the use of plastics was expected to rise as manufacturers moved away from metal.

Since 1982, between 125 and 150 collection sites have been established by municipalities in the province, usually at or near municipal landfills. However these sites are not regulated or registered with the Department of Environment and the municipalities are responsible for the draining and crushing of the containers and storage of the residues in 205 litre drums.

Metal containers are punctured and crushed, and the resulting residues collected during this operation. The crushed metal containers are buried in municipal landfills or recycled as scrap.

The latter practice (recycling) has recently become difficult due to the reluctance of scrap dealers and steel mills to accept unrinsed containers, recognizing that they could be considered a hazardous waste. According to the Weed Control Districts, plastic containers are primarily being burned in open trenches. The Department of Environment is responsible for the collection of these residues and was responsible for their disposal until 1987 when this and the operation of the temporary storage facility at Gimli was assumed by the Corporation.

According to the Department of Agriculture's 1987 summary of the Manitoba Agriculture Container Disposal Survey, 57% of the containers collected by Weed Control Districts in 1987 were plastic. Most of these containers were burned and others buried in municipal landfills. Based on sales data and comparisons with other provincial jurisdictions,

approximately 545,000 pesticide containers were used in Manitoba in 1988. According to the Department of Agriculture, approximately 300,000 containers are being collected in voluntary collection areas. The final destruction, disposal or dispersal of the remaining 200,000 to 245,000 containers used annually in Manitoba is not known.

In 1988, an understanding was reached between Manitoba, Saskatchewan and Alberta Departments of Environment and the Crop Protection Institute of Canada (CPIC) to work co-operatively in the development of a management program for pesticide containers in their respective provinces. To facilitate this process, a dollar surcharge has been collected by the CPIC through the sale and distribution of pesticide products since November 1988. These funds are currently being administered by CPIC, however the development of a non-profit corporation to manage a province-wide pesticide container program in Manitoba has been proposed. It is anticipated that the funding will be applied to contracting a comprehensive management program on a commercial basis. This is currently being done in Saskatchewan and is under consideration in Alberta.

The interest of the Manitoba Hazardous Waste Management Corporation in this issue is based on its mandate to develop an overall operational hazardous waste management system in the province and the identification of pesticide containers as a significant waste stream requiring management. Initially, the Corporation limited its involvement to the storage of residues collected by the municipalities and provincial government, and arranging for their treatment and disposal at qualified facilities in Eastern Canada and the United States.

With the initiation of the container surcharge program intended to finance a more comprehensive system to address the problem, the Corporation initiated study work on the issue in 1988 through the Natural Resources Institute at the University of Manitoba (Dessens, 1989). In addition, the pilot project described in this report was undertaken in July 1989. This was a direct result of discussions held with the Department's of Environment and Agriculture, the Crop Protection Institute, farm organizations and farm chemical distribution organizations in June 1989, regarding a conceptual approach developed by the Corporation (Appendix A).

3.0 MANAGEMENT PROCESS

The basic assumptions made in developing this management process are as follows:

1. The scope is a comprehensive solution where all containers and the resultant solid and hazardous components are managed in an environmentally sound manner.

2. Unrinsed containers are considered regulated hazardous waste and are unsuitable for conventional solid waste management or recycling.

3. Solid waste recycling would be maximized to the extent dictated by markets and acceptability.

4. Landfill disposal of uncontaminated or decontaminated solid waste can be used conditional on only Class 1 facilities (where only burial without burning is permitted) be used and volume reduction is maximized.

The site selected for the pilot project was a relatively small site located in and operated by the Rural Municipality of Rossburn in South Western Manitoba. It was established in 1987 on a road allowance remote from the municipal landfill, on Provincial Road 254

approximately 2 km north of the Village of Rossburn. The site is located more than 1 km from the nearest farm residence on relatively impermeable glacial till, offering good ground water protection. However, it could be subject to seasonal surface water runoff. The actual compound consisted of a 7.5 meter by 15 meter area , having a 1.5 meter wire fence and a 5 meter access opening facing the approach from the highway. In comparison to most such sites, this site was judged as being well organized and sited.

Inspection of the site revealed that no segregation of material was practiced and significant quantities of other waste, specifically cardboard containers in which the pesticides were originally supplied were also deposited. The compound area was essentially full to capacity with material piled to a height of approximately 3 meters at the access opening.

In order to establish a basis for the analysis of the process steps, a review of existing information on the types and formulations of pesticides used in Manitoba was also undertaken. Based on information reported by the Natural Resources Institute (Dessens and MacPherson, 1989), the fifteen most frequently used pesticides were identified. This was confirmed by the on-site inspection conducted at the collection area. In addition, the following information provided by Manitoba Agriculture was reviewed to determine the concentrations of these pesticide formulations and their application concentrations:

1989 Guide to Chemical Weed Control

1989 Manitoba Insect Control Guide

1989 Manitoba Plant Disease Control Guide For Cereals, Potatoes, Special Crops and Vegetables

The following three step process for the management of pesticide containers and residues was employed:

Step 1 Material Segregation

Step 2 Liquid Waste Collection and Treatment

Step 3 Solid Waste Disposal

Step 1 is the segregation of the unorganized site into metal, plastic and cardboard.

In Step 2, as an initial stage in the decontamination process, the containers were manually drained to remove any residues. It was noted that few metal containers appeared rinsed, but up to 50% of the plastic containers had been. The containers were then rinsed using one high pressure rinse and one low pressure rinse. The high pressure rinse was achieved by an electrical pump, using a specially designed nossel that punctures the container and sprays the walls uniformly. In order to reduce the quantity of rinsate generated in the rinsing process, the rinse water was recirculated until a concentration of 8400 parts per million (ppm) was reached. This was chosen as the limiting concentration based on it being the average mean field application concentration for most of the products involved and as such represents a conservative boundary for defining a regulated hazardous waste.

Once this concentration was reached, fresh rinse water was used. A secondary low pressure rinse (Final Rinse) was used as a check on the efficiency of the initia' rinse. This rinse was achieved by a hand pump applicator. This type of device was selected as it minimizes the amount of water used and therefore reduces the amount of rinsate generated. Both the residue and rinsate were collected in standard 205 litre drums for transfer as hazardous waste to the Corporation's approved storage facility and ultimately to out of province licensed disposal facilities.

In Step 3, the decontaminated metal containers were crushed and transferred to metal recycling facilities. Although plastics could be decontaminated to levels acceptable for material handling and disposal, the viability of recycling was viewed as questionable due to the retention of pesticides absorbed by the containers and a current lack of market for this material. Therefore, the plastic containers were shredded using a modified tree shredder and transferred to a Class 1 landfill in 3 mil plastic bags. In order to facilitate this proposed management option, the Corporation approached the Department of Environment for the "delisting" of pressure or triple rinsed containers as hazardous waste. Approval for this practice was received subject to analytical verification (Appendix B). Subsequently, this material was accepted by the City of Winnipeg for burial at the City's Brady Road landfill.

In summary, 3500 containers (2100 plastic and 1400 metal) were managed in this pilot project. A total of 615 liters of residues were drained and collected from these containers. The draining of the plastic and metal containers resulted in 103 and 512 liters of residues respectively. The rinsing process generated a total of 2050 liters of rinsate, 615 liters from the plastic containers and 1435 from the metal containers. In total, 2665 liters (13 - 205 litre drums) of pesticide liquids were collected and managed as hazardous waste. The solid waste component consisted of 3 tonnes of metal, 1 tonne of shredded plastic and 1 tonne of cardboard.

4.0 MONITORING PROGRAM

In order to assess the effectiveness of the management process and ensure a satisfactory level of container decontamination, a monitoring and sampling program was developed. The analytical work was contracted to the Manitoba Research Council. Prior to implementing the pilot project, the top fifteen frequently used pesticides in Manitoba were grouped into analytical categories along with their formulation and application range concentrations (Appendix C). Based on these groups, a visual field confirmation of these products at the container site and discussions with the Manitoba Research Council, 2,4-D, MCPA, Poast, Roundup, Treflan, Avadex, Hoegrass, Banvel, Avenge and Buctril M were selected as the analytical parameters.

As noted above, it was proposed that the average mean of the application concentrations, 8400 ppm, be used to establish the upper limit for the rinse water used to decontaminate containers. The previous pilot project conducted by the Department of Environment in 1982 found that between 50 and 250 millilitres (ml) of pesticide residues remain in unrinsed containers and at least 50% of the containers were not rinsed. Based on this information and the average pesticide formulation concentrations, and assuming that 15 ml of residue will remain after initial draining of the containers, estimates were made of the number of containers that could be rinsed before the rinse water (rinsate) would reach the upper limit level of 8400 ppm established.

A sampling frequency for the rinsate was based on this information and modified in the field. To provide monitoring control in the field, an immunoassay kit was used to detect 2,4-Dichlorophenoxyacetic acid (2,4-D) and other phenoxy -acid pesticides (Appendix D). Seven of the top fifteen most frequently used pesticides in Manitoba are in this group.

Samples of the shredded plastic containers were collected for analysis of pesticide residues as an indicator of the efficiency of the rinsing process and the suitability of the proposed management of the decontaminated containers at a Class 1 landfill. Samples of the cardboard were also taken to determine residue levels. Control samples of rinse water and reagent water were also analyzed.

5.0 ANALYTICAL RESULTS AND DISCUSSION

Grab samples of the plastic container rinsate and final rinse were taken for laboratory analysis after rinsing 50, 100, 350 and 450 containers respectively . The results indicate relatively low levels of the selected analytical pesticide parameters reflecting the better draining characteristics of the plastic containers and a greater frequency of triple rinsing by the users (Appendix E). This was confirmed by the similar low levels detected in the final rinse water generated from the secondary rinsing of 450 containers. Some inconsistencies were observed in the results which have been attributed to the sample homogeneity due to the interaction and variable solubility of the chemical formulations, and sampling technique. Greater consistency could be achieved with the use of a Coliwasa sampler. Field tests using the Immunoassy Pesticide Test Kit on the plastic container rinsate were conducted at 100, 250 and 450 respectively. The 1 and 10 ppb control standards were used to establish relative 2,4-D/MCPA levels in the samples. Although the results were consistent with the laboratory results, colourimetic interpretation was difficult in the field. Greater consistency and accuracy could be achieved through the use of a photometer.

Based on experience from the draining process, the metal containers retained a significant amount of residue. A decision was made not to reuse the rinse water as in the case of the plastic containers. Grab samples of two metal container rinsates were taken after rinsing 240 and 150 containers. The results of the rinsate samples confirmed the retention of pesticide residues in the containers, with rinsate levels approaching 10,000 ppm (1%) 2,4-D/MCPA for the 240 container rinsate (Appendix F). Similar levels were detected in the final rinse water resulting from the secondary rinsing of 300 and 500 containers respectively. This is attributed to carry-over from the initial rinse due to the poor draining characteristics of the metal containers and the relative low dilution of the final rinse. As in the case with the plastic containers, inconsistencies can be attributed sample homogeneity. The field test using the Immunoassay Pesticide Test Kit on the 240 container rinsate was consistent with the laboratory results.

Samples of cardboard and shredded plastic containers from the site were collected for pesticide analysis. A sample of unrinsed shredded plastic containers was obtained from the current Saskatchewan container management program for comparative analysis. The samples of cardboard and shredded plastic containers were leached using a modified leachate test protocol listed in Manitoba Regulation 282/87 (Appendix G).

The cardboard was manually cut into smaller pieces and strips and 900 grams of randomly chosen pieces were placed into a 20 litre aluminum pail with 14.4 liters of distilled water. The pail was mechanically rocked for 24 hours, with occasional manual rotation at intervals during the first 6 hours. After this time the pH of the leachate was 5.9 and the volume was 800 millilitres. This was diluted with distilled water to a final volume of 1000 millilitres and analyzed for the selected pesticides.

The shredded plastic containers from the study were cut into pieces approximately 5 centimeters square using a band saw. The plastic pieces were agitated using a rotary extractor. To minimize the possible bias due to the non-homogeneous nature of the sample, five Teflon bottles of 50 grams sample per 800 millilitres of distilled water were used. During the 24 hour agitation, the pH of the leachate was adjusted to 5. After 24 hours the leachate volume of each bottle was adjusted to 1000 millilitres and the leachates were mixed to provide a composite sample for analysis.

The levels of selected pesticides detected in the leachates of the cardboard and both the rinsed and unrinsed container were low (Appendix H). This supports the observation made during the draining process that the majority of plastic containers are rinsed by the users and the containers have better draining characteristics.

6.0 CONCLUSION AND RECOMMENDATIONS

As an overall conclusion, the pilot program report here provided a good analytical and operational experience base to develop a cost effective commercial program that could be applied on a provincial scale in compliance with prevailing regulatory standards. Based on the observations and results of this project, the following specific conclusions were drawn:

1. The management and operational efficiency of a pesticide container and residue management program can be improved with the segregation of plastic and metal containers through the proper design and operation of collection sites, and educational programs.

2. The majority of containers deposited at the collection site are intact (not punctured) and capped. Residues from unrinsed containers will remain in the containers.

3. Significant quantities of pesticide residues are retained in the deposited containers, indicating that a residue draining step will be required in any management program

4. Metal containers retain significantly more residue per container than plastic containers (7.5 X), reflecting the better draining characteristics and a greater frequency of triple rinsing by the users for plastic containers.

5. Although pesticide residue levels remaining in drained plastic containers are low, both plastic and metal containers should be rinsed to provide assurance of decontamination and access to solid waste management options. This may cost effectively be accomplished through the use of a pressurized rinsing system. Rinsate from the plastic containers may be recirculated to reduce the volume of rinsate waste requiring treatment.

6. As is the case for residues, rinsing of metal containers generates significantly more rinsate (3.5 X) requiring management as a liquid hazardous waste than plastic containers.

7. Both the metal and plastic containers should be acceptable to the regulatory authorities as non-hazardous waste after draining and rinsing.

8. Metal containers should be crushed or shredded and are locally acceptable for recycling. Plastic containers should be shredded and transported to a Class 1 landfill for burial until an economically viable resource recovery option is available.

9. Cardboard containers do not retain sufficient levels of pesticide residues to be considered as hazardous waste. These materials may be managed as solid wastes.

10. There is potential for the development of specialized equipment to improve operational efficiency and reduce operating costs.

Based on the above conclusions, the following recommendations should be considered in the development of a pesticide container and residue management program:

1. Collection depots should be designed and operated in a manner that would encourage the segregation of metal, plastic and cardboard containers.

2. An educational program should be undertaken to encourage pesticide users to triple rinse containers, deliver intact and capped containers to collection depots and segregate containers.

3. All containers should be drained and rinsed to provide a sufficient level of decontamination to facilitate their designation by regulatory authorities as non-hazardous. Unrinsed containers should be regulated as hazardous waste.

4. Standards for collection depots, container decontamination, and management of decontaminated containers should be developed.

5. Metal containers should be recycled and plastic containers should be buried at Class 1 landfills until alternative resource recovery options become available.

6. The inherent higher residue and rinsate generation resulting from proper management of metal containers relative to plastic containers, coupled with the significant proportion that disposal costs will contribute to overall program costs (60%), suggest that the current practice of applying a common surcharge on both types of containers should be reviewed.

7. Research on plastic container design, recycling and reuse should be conducted.

8. Specialized equipment should be developed to improve the efficiency of the draining, rinsing and processing of the containers.

REFERENCES

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APPENDIX A

MANITOBA HAZARDOUS WASTE MANAGEMENT CORPORATION

CONCEPTUAL PROPOSAL

for

MANAGEMENT OF PESTICIDE CONTAINERS AND RESIDUES

The MANITOBA HAZARDOUS WASTE MANAGEMENT CORPORATION would undertake to operate, as prime contractor, the complete program of pesticide container management.

The CORPORATION would provide supervision, training, administration and hazardous waste management.

The CORPORATION would sub contract rinsing, shredding, crushing, transportation and disposal of residue. All activities will be under the direct supervision of the Corporation's qualified technicians to ensure compliance with all applicable legislation.

The CORPORATION, in consultation with the client, would identify the sites requiring removal of pesticide containers and mutually assess the scope of work to be performed with the client.

Subject to the above, the CORPORATION would perform the following work:

1) Containers will be TRIPLE RINSED.

2) The rinsate will be collected in drums and transported to our storage facility in Gimli.

3) Arrange for transportation and disposal of rinsate to a qualified out of province facility.

4) The metal containers will be crushed, and upon confirmation by the regulatory agency that the containers are non-hazardous, they would then be transported to a recycling facility.

5) The plastic containers will be shredded and transported to a Class #1 landfill for burial, subject to regulatory and municipal approval.

6) The Corporation would undertake the negotiations with the appropriate municipality to permit the disposal of the plastic waste at the landfill subject to support from the Department of the Environment.

7) Commercial arrangements are dependant on the scope to be defined as noted above.

June 8, 1989

APPENDIX B

Manitoba
Hazardous Waste
Management Corporation

226 — 530 Century Street, Winnipeg, Manitoba R3H 0Y4 Telephone: (204) 945-1844

July 13, 1989

Mr. Norm Brandson
Director
Environmental Management Services
Department of Environment
Building 2, 139 Tuxedo Blvd.
Winnipeg, Manitoba
R3N 0H6

Dear Norm:

As you may be aware, the Corporation has been involved in discussions with staff from the Department, other Provincial government departments and agricultural organizations regarding a commercial contract for the disposal of pesticide containers and residues. It is our understanding that this is to be undertaken using funding provided by the Crop Protection Institute of Canada (CPIC).

The Corporation's proposal will involve the collection of residues, triple rinsing of containers and subsequent collection of the rinsates and the crushing and shredding of metal and plastic containers respectively. On its own initiative the Corporation will be conducting a pilot project in the R. M. of Rossburn, July 24 to 26, 1989 to evaluate procedures to be proposed. On-site analysis and sampling of the rinsates and shredded plastic containers will be conducted for further laboratory analysis and pertinent data will be collected.

In order to facilitate an environmentally acceptable and cost effective solution for the management of the metal and plastic containers, the Corporation would like to pursue the option of recycling the crushed decontaminated metal containers and landfilling of the shredded decontaminated plastic containers at Class 1 landfills. It is our assessment that this is the most economic and environmentally acceptable method of disposing of plastic materials. The alternative of burning them on-site as has traditionally been done is unacceptable. No current option exists to recycle them. Options involving long term storage or high temperature incineration are extremely expensive.

As a prerequisite for pursuing this option, a regulatory interpretation is needed respecting the designation of the triple or pressure rinsed containers as non-hazardous waste materials. This interpretation will be necessary in order to obtain Municipal cooperation to secure access to Class 1 landfills.

I would appreciate your consideration and response to this matter. More specifically, we have been advised by the City of Winnipeg that written confirmation of the non-hazardous designation of the material is required from the Department.

Yours truly,

Edwin J. Yee
Manager, System Development

cc: R.J Cooke
W. deBakker
File 501.2

Manitoba

Environment

Environmental Management

Building 2
139 Tuxedo Avenue
Winnipeg, Manitoba, CANADA
R3N 0H6

July 24, 1989

RECEIVED
JUL 26 1989
MHWMC

Mr. Edwin Yee
Manager of System Development
Manitoba Hazardous Waste Management Corporation
226 - 530 Century Street
Winnipeg, Manitoba
R3H 0Y4

Dear Ed:

I am replying to your July 13, 1989 letter concerning the disposal of pesticide containers.

Triple or pressure rinsed pesticide containers are not considered to be a hazardous waste by the Manitoba Department of Environment. The disposal of such containers, shredded or crushed, at a Class 1 Waste Disposal Ground is acceptable to the Department.

With respect to the pilot project outlined in your letter, I would suggest that a leachate test be performed on samples of the shredded containers as a confirmation of the efficiency of triple or pressure rinsing.

I look forward to hearing more about the Corporation's involvement in helping to deal with the accumulation of discarded pesticide containers.

Sincerely,

Norm Brandson
Director
Environmental Management
Services

cc. Bill Carroll

APPENDIX C

FREQUENTLY USED PESTICIDES IN MANITOBA

PESTICIDE	GROUP	CONC. (1000 PPM)	APPLICATION RANGE (1000 PPM)	RANGE MEAN
Poast	X	184	2.2 - 4.2	3.2
MCPA Na Salt	P	500	1.0 - 4.0	2.5
Hoe-Grass	O	284	6.0 - 9.0	7.5
Banvel	P	480	2.7 - 10.6	6.7
2,4-D	P	500	1.0 - 4.0	2.5
Treflan	N	545	7.4 - 18.0	12.7
Roundup	X	356	2.7 - 38.0	20.4
Buctril M	P	560	2.0 - 28.0	15.0
Avenge	X	200	6.3 - 7.6	7.0
Estraprop	P	582	1.0 - 4.0	2.5
Lontrel	X	200	1.0 - 2.7	1.9
Hoe-Grass II	P	310	9.8	9.8
Avadex BW	N	400	10.8 - 19.8	15.3
Bladex	N	480	12.9 - 16.0	14.5
Target	P	400	3.6 - 5.4	4.5
			AVERAGE MEAN	8.4
		AVERAGE PESTICIDE FORMULATION CONC.		400.0

N - Organo-nitrogen
O - Organo-chlorine
P - Phenoxy acid
X - Other

APPENDIX D

RES-I-MUNE™ for 2,4-DICHLOROPHENOXYACETIC ACID (2,4-D)

DETAILED INSTRUCTIONS

READ ALL INSTRUCTIONS BEFORE PROCEEDING.
ALLOW ALL REAGENTS TO COME TO ROOM TEMPERATURE BEFORE PROCEEDING.

1. Remove 2 antibody coated tubes from plastic bag. Mark one "-" for NEGATIVE CONTROL and one "S" for SAMPLE.

2. Using the NEGATIVE CONTROL from the kit add 4 drops to the tube; add 4 drops (or 160 microliters from a pipette) of SAMPLE to tube "S".

3. Immediately add 4 drops of enzyme conjugate to each tube. Swirl tubes gently and mix for 2-3 seconds.

4. Leave tubes undisturbed for 10 minutes.

5. Shake out contents of both tubes. Refill completely with tap or distilled water. Decant tubes, shaking out remaining water.
REPEAT WASH STEP THREE MORE TIMES.
Remove as much water as possible on the last wash step.

6. Add 4 drops of SUBSTRATE to each tube.
Follow immediately with 4 drops of CHROMOGEN to each tube.
IMPORTANT: DO NOT REVERSE THIS ORDER OF REAGENT ADDITION.
Mix tubes gently for 2-3 seconds.

7. Leave tubes undisturbed for 5 minutes.

8. Results may be read visually at this point (see section on "VISUAL INTERPRETATION") or the reaction terminated by the addition of ONE DROP of STOP SOLUTION to each tube and mixing gently. This will arrest the blue color development and turn the reaction solution yellow. See section on "READING STOPPED TUBES".

VISUAL INTERPRETATION

A SAMPLE tube containing LESS color than the NEGATIVE CONTROL tube indicates the presence of 2,4-D.

USE OF OTHER CONTROLS

The 1 PPB or 10 PPB CONTROL may be used instead of the NEGATIVE CONTROL. Visual interpretation is as above, with color inversely proportional to 2,4-D concentration. A tube containing LESS color than a CONTROL tube has MORE 2,4-D than that CONTROL tube. A tube containing MORE color than a CONTROL tube has LESS 2,4-D than that CONTROL level. Due to the rapid kinetics of this system, DO NOT attempt to assay more than a total of 6 tubes per run.

READING STOPPED TUBES

To each "stopped" tube add 0.5 ml of water and mix well. The absorbance may be read against a water blank, at 450 nm, on a suitable photometer. A field portable photometer is available from ImmunoSystems. Absorbance values are compared to the CONTROL used. Tubes with a LOWER absorbance value relative to a CONTROL tube have a HIGHER 2,4-D level than that CONTROL. Tubes with a HIGHER absorbance value relative to the CONTROL tube have a LOWER level of 2,4-D relative to that CONTROL.

DETECTION LIMIT

The least detectable concentration of 2,4-D in water detectable with this kit

2,4-D CROSS REACTIVITY SUMMARY

*50% B_o DOSE:	1-10	10-100	100-1000	1000 PPB
COMPOUND NAME				
2,4-D	X			
2,4-D Methyl Ester		X		
2,4,5-T		X		
Dichlorprop		X		
2,4-D Isopropyl Ester			X	
2,4-DB			X	
MCPA			X	
2,4,5-TP (Silvex)			X	
2,4-Dichlorophenol				X
2,4-DB Butyl Ester				X
2,4-DB Isobutyl Ester				X
Dicamba				X
Endothall				X
Diclofop-Methyl				X

*50% B_o DOSE = that concentration of compound which causes 50% Inhibition (50% of the "zero" signal).

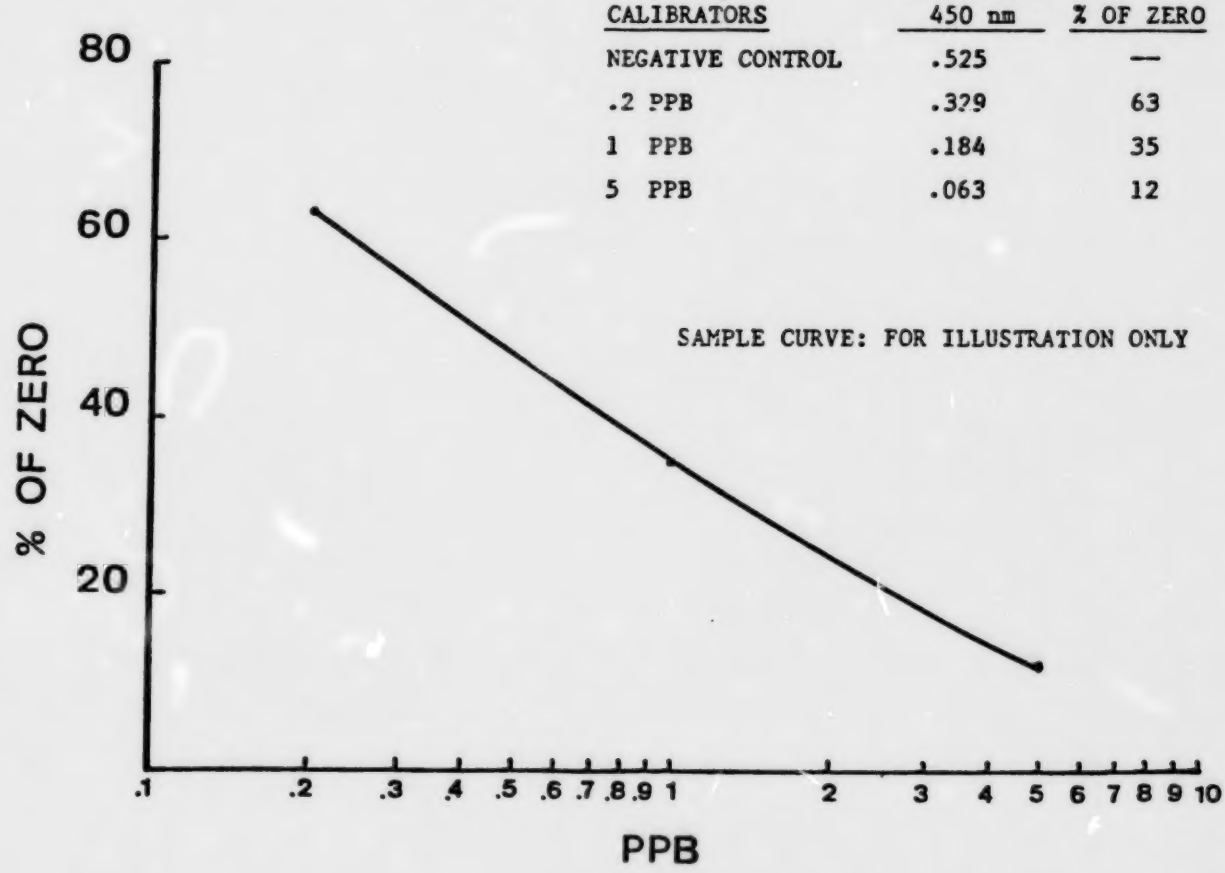
OTHER PHOTOMETERS

After stopping the reaction with one drop of STOP SOLUTION add 0.5 ml of water and mix gently. Adjust the wavelength of your photometer to 450 nm and zero against a water blank. The reaction liquid may be transferred to an appropriate cuvette or aspirated directly into the photometer, depending on make and model.

TO QUANTITATE RESULTS

1. Record the absorbance and dose level of each CALIBRATOR and NEGATIVE CONTROL. CALIBRATORS may be used directly as supplied or other levels may be made by diluting CALIBRATORS with distilled or deionized water.
2. Record the absorbance of each sample.
3. Divide the absorbance of each CALIBRATOR and sample by the absorbance of the NEGATIVE CONTROL, then multiply the result by 100 to obtain "% OF NEGATIVE CONTROL" (% OF ZERO).
4. On semi-log paper plot "% OF ZERO" for each CALIBRATOR vs. the dose of that CALIBRATOR.
5. Connect these points with a smooth curve as shown in the example below.
6. Dose values of samples may be obtained by reading the dose corresponding to the "% OF ZERO" for that sample from the constructed graph.

(DOSE) CALIBRATORS	ABSORBANCE 450 nm	% OF ZERO
NEGATIVE CONTROL	.525	—
.2 PPB	.329	63
1 PPB	.184	35
5 PPB	.063	12



SAMPLE CURVE: FOR ILLUSTRATION ONLY

DIFFERENTIAL PHOTOMETER

PRINCIPLES OF OPERATION

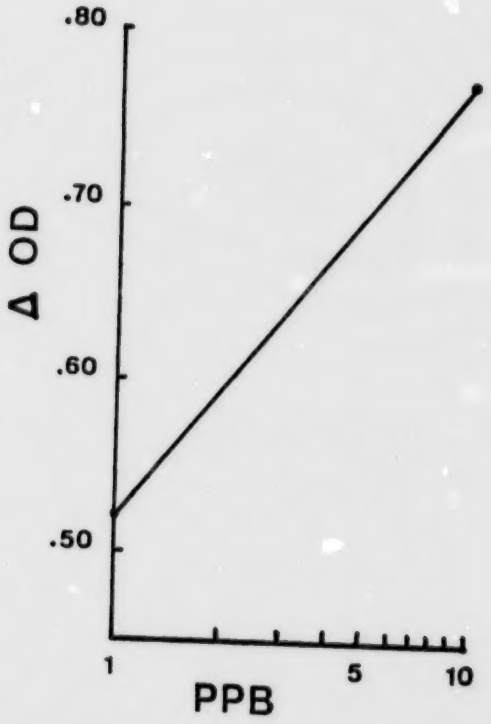
The differential photometer displays the optical density difference between two tubes at 450 nm. Specifically, the display is the optical density of the left hand tube subtracted from the optical density of the right hand tube.

OPERATION

After stopping the assay with one drop of STOP SOLUTION add 0.5 ml of water to each tube and mix gently. Place the NEGATIVE CONTROL tube in the right hand well of the photometer and POSITIVE CALIBRATOR tube in the left hand well. Depress and hold the display button, wait 2-3 seconds for the display to settle, record POSITIVE CALIBRATOR level and display value. Remove CALIBRATOR tube and replace with next level CALIBRATOR tube, read as above, recording CALIBRATOR level and display value. Sample tubes are read in the same manner.

QUANTITATION

For quantitation, a NEGATIVE CONTROL plus POSITIVE CALIBRATORS are assayed along with samples and a graph of Optical Difference (ΔOD) linear scale is plotted against the CALIBRATOR Dose Value, log scale. The dose value of samples can be read from this standard curve. Samples with ΔOD values less than the ΔOD for the 1 PPB CALIBRATOR contain less than 1 PPB atrazine, and samples with ΔOD values greater than the ΔOD of the 10 PPB CALIBRATOR contain more than 10 PPB atrazine.

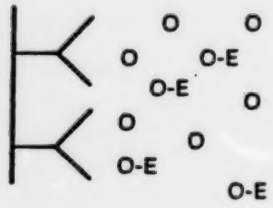


The differential photometer available from ImmunoSystems is a hand-held, battery powered unit weighing approximately 2 lbs. It is suitable for field or laboratory use. Refer to Price Schedule.

PRINCIPLES OF THE TEST

Test principles are based on using antibodies which recognize both atrazine and atrazine-enzyme conjugate. Atrazine in the sample "competes" with atrazine-conjugate for a limited number of antibody binding sites, as illustrated below.

1.



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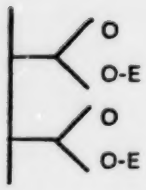

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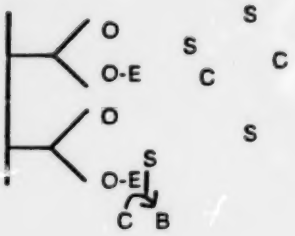

Antibodies which recognize atrazine are bound to the walls of the test tube.

1. A sample containing atrazine (O) is introduced into the tube, followed by atrazine-enzyme conjugate (O-E) which competes with atrazine for the same antibody recognition site.

2. This mixture is incubated for 5 minutes and unreacted molecules are washed away.

3. Clear solutions of substrate (S) and chromogen (C) are then added to the tube. In the presence of bound enzyme conjugate the substrate is converted to a compound which causes the chromogen to turn blue (B).

   One enzyme can act on many substrate molecules which in turn converts many chromogen molecules to blue.

Since there are the same number of antibody sites available on every tube and each tube receives the same number of atrazine-conjugate molecules, a sample containing a low concentration allows many atrazine-conjugate molecules to be bound by the antibody. Therefore, a low concentration of atrazine will give rise to a dark blue color. Conversely, a high concentration of atrazine will allow fewer atrazine-conjugate molecules to be bound by the antibodies, resulting in lighter blue color.

Color is inversely proportional to concentration:

DARKER COLOR = LOWER CONCENTRATION

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APPENDIX E

SELECTED PESTICIDE LEVELS IN THE PLASTIC CONTAINER RINSATE (PPM)

PESTICIDE/SAMPLE #	P1	P2	P3	P4	P5	P6
2,4-D/MCPA	154	113	<10	149	81	225
POAST	21	61	<10	<10	<10	<10
ROUNDUP	<10	<10	<10	<10	<10	<10
TREFLAN	<10	<10	<10	10	19	18
AVADEX	<10	<10	<10	<10	<10	<10
HOEGRASS	<10	<10	<10	<10	<10	<10
BANVEL	<10	<10	<10	21	<10	42
AVENGE	<10	88	<10	75	57	55
BUCTRIL M	<10	<10	<10	251	<10	<16

< LESS THAN
P1 50 CONTAINER RINSATE
P2 100 CONTAINER RINSATE
P3 BLANK
P4 350 CONTAINER RINSATE
P5 450 CONTAINER FINAL RINSE WATER
P6 450 CONTAINER RINSATE

APPENDIX F

SELECTED PESTICIDE LEVELS IN THE METAL CONTAINER RINSATES (PPM)

PESTICIDE/SAMPLE #	M1	M2	M3	M4	M5
2,4-D/MCPA	<10	9,593	11,361	497	9,995
POAST	<10	<10	22	12	33
ROUNDUP	<10	<10	<10	<10	<10
TREFLAN	<10	164	84	63	146
AVADEX	<10	620	93	483	419
HOEGRASS	<10	1,527	821	604	1,071
BANVEL	<10	30	<10	78	<10
AVENGE	<10	<10	650	<10	62
BUCTRIL M	<10	1,358	896	118	813

< LESS THAN
M1 BLANK
M2 240 CONTAINER RINSATE
M3 300 CONTAINER FINAL RINSE WATER
M4 150 CONTAINER RINSATE
M5 500 CONTAINER FINAL RINSE WATER

APPENDIX G

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SCHEDULE B
ANALYTICAL METHODS FOR LEACHATE EXTRACTION PROCEDURE

LEACHATE EXTRACTION PROCEDURE

(1) Sampling

Collect a sufficient amount of sample to provide approximately 100 g of solid material, using techniques which ensure that the sample is representative of the product or substance.

(2) Equipment

2.1 Sieve, 9.5 mm mesh opening, stainless steel or plastic material.

2.2 Stainless steel filtration unit, 142 mm diameter, minimum 1L capacity, capable of sustaining a pressure of 5 kg/cm^2, applied to the solution to be filtered. 75psi

2.3 Membrane filter, 142 mm diameter, 0.45 μm diameter pore size, made of synthetic organic material such as cellulose acetate, cellulose nitrate, nylon or polycarbonate and which is compatible with the leachate to be filtered. Teflon is recommended for organic constitutents.

2.4 Glass fibre prefilter, 124 mm diameter, 3 μm to 12 μm pore size range.

2.5 Vacuum filtration unit, 90 mm diameter.

2.6 Membrane filter 90 mm diameter as per Step 2.3.

2.7 Glass fibre filter 70 mm diameter as per Step 2.4.

2.8 Solid waste rotary extractor – a device that rotates the bottles end over end about a central axis through 360°, with a speed of 10 rpm. The dimensions of the box will depend on the needs of each laboratory. (Figure 1).

2.9 Structural Integrity Tester with a 3.18 cm diameter hammer weighing 0.33 kilogram and having a free fall of 15.24 cm. (Figure 2).

2.10 pH meter, with a readability of 0.01 pH unit and accuracy of ± 0.1 pH units.

2.11 Cylindrical bottles, wide mouth, 1250 mL capacity, polyethylene or glass with Teflon lined cap for inorganic constituents; glass with Teflon-lined cap or Teflon bottles for organic constituents.

2.12. Cleaning Procedure

All glassware and equipment that comes into contact with the sample should be cleaned in the following way before each use:

2.12.1 Wash with a non-phosphate detergent solution.

2.12.2 Rinse twice with tap water.

2.12.3 Rinse twice with reagent water.

2.12.4 Wash with 10% nitric acid.

2.12.5 Rinse several times with reagent water.

2.12.6 Store bottles filled with 10% nitric acid, until ready to use.

2.12.7 Rinse several times with reagent water before use.

2.12.8 Rinse clean oven dried bottles with methylene chloride, followed by methanol, for organic constituents.

(3) Reagents

3.1 Acetic acid, 0.5 N. Dilute 29.4 mL of concentrated acetic acid (ACS grade) to 1000 mL with reagent water.

3.2 Reagent water, Type IV (ASTM Specification D 1193). For organic parameters, the reagent water should be free of any organic substances to be analyzed (ASTM Type 1).

3.3 Nitric acid, 10% (volume/volume). Add 100 mL of concentrated nitric acid (ACS grade) to 900 mL of reagent water.

3.4 Nitrogen gas, pre-purified, scrubbed through a molecular sieve.

(4) Separation Procedure

If the sample contains a distinct liquid and a solid phase, separate it into its component phases using the following procedure:

4.1 Determine the dry weight of the solids in the sample at [redacted], using a well homogenised sample. Use this weight to determine the amount of material to be filtered.

4.2 Assemble the filtration unit with a filter bed consisting of a 0.45 m pore size membrane filter and a coarse glass fibre pre-filter upstream of the membrane filter (per manufacturer's instructions).

4.3 Select one or more blank filters from each batch of filters. Filter 50 mL portions of reagent water through each test filter and analyze the filtrate for the analytical parameters of interest. Note the volume required to reduce the blank values to acceptable levels.

4.4 Wash each filter used in the leach procedure with at least this pre-determined volume of water. Filter under pressure until no water flows through the filtrate outlet.

4.5 Remove the moist filter bed from the filtration unit and determine its weight to the nearest ± 0.01 g.

4.6 Re-assemble the filtration unit, replacing the filter bed, as before.

4.7 Comminute the sample, with a mortar and pestle, to a size that will pass through the opening of the filtration unit (less than 9.5 mm).

4.8 Agitate the sample by hand and pour a representative aliquot of the solid and liquid phases into the opening of the filtration unit. Filter a sufficient amount of the sample to provide at least 60 g of dry solid material.

4.9 Pressurize the reservoir very slowly with nitrogen gas by means of the regulating valve on the nitrogen gas cylinder, until liquid begins to flow freely from the filtrate outlet.

7 psi 75 psi

4.10 Increase the pressure step-wise in increments of 0.5 kg/sq. cm to a maximum of 5 kg/sq. cm, as the flow diminishes. Continue filtration until the liquid flow ceases or the pressurizing gas begins to exit from the filtrate outlet of the filter unit.

4.11 De-pressurize the filtration unit slowly using the release valve on the filtration unit. Remove and weigh the solid material together with the filter bed to ± 0.01 g. Record the weight of the solid material.

4.12 Measure and record the volume and pH of the liquid phase. Store the liquid at 4°C under nitrogen until required in Step 5.13.

4.13 Discard the solid portion if the weight is less than 0.5% (weight/volume) of the aliquot taken. If not, proceed to Step 5.1.

Note: For mixtures containing coarse grained solids, where separation can be performed without imposing a 5 kg/sq. cm differential pressure, a vacuum filtration unit with a filter bed as per Step 4.2 may be used. Vacuum filtration must not be used, if volatile organic compounds are to be analysed.

(5) Extraction Procedure

5.1 Prepare a solid sample for extraction by crushing, cutting or grinding, to pass through a 9.5 mm mesh sieve. If the original sample contains both liquid and solid phases, use the solid material from Step 4.13. The structural integrity procedure, Step 6, should be used for monolithic wastes which are expected to maintain their structural integrity in a landfill, (e.g. some slags and treated solidified wastes).

Note: Do not allow the solid waste material to dry prior to the extraction step.

5.2 Determine the moisture content of the de-watered sample, by drying a suitable aliquot to constant weight at 60°C in an oven. Discard the dried solid material.

5.3 Place the equivalent of 50 g dry weight of the de-watered undried material into a 1250 mL wide mouth cylindrical bottle. Use additional bottles, if a larger volume of leachate is required for the analysis.

5.4 Add 800 mL (less the moisture content of the sample in mL) of reagent water to the bottle.

5.5 Cap the bottle and agitiate it in the rotary extractor for 15 minutes before pH measurement.

5.6 Measure and record the pH of the solution in the bottle using a pH meter, calibrated with buffers at pH 7.00 and pH 4.00. The solution should be stirred during the pH measurement.

5.7 Proceed to Step 5.10.1, if the pH is less than or equal to 5.2.

5.8 Add a sufficient volume of 0.5N acetic acid if the pH is greater than 5.2 to bring the pH to 5.0 ± 0.2.

Note: Maximum Amount of Acid: No more than 4 mL of 0.5N acetic acid per gram of dry weight of sample may be added during the entire procedure. If the pH is not lowered to 5.0 ± 0.2 with this amount, proceed with the extraction.

5.9 Cap the bottle and place it in the tumbling apparatus. Rotate the bottle and its contents at 10 rpm for 24 hours at room temperature (20°C to 25°C).

5.10 Monitor, and mannually adjust the pH during the course of the extraction, if it is greater than 5.0 ± 0.2. The following procedure should be carefully followed:

5.10.1 Measure the pH of the solution after 1 hour, 3 hours and 6 hours from the starting time. If the pH is above 5.2, reduce it to pH 5.0 ± 0.2 by addition of 0.5N acetic acid. If the pH is below 5.0 ± 0.2, do not make any adjustments.

5.10.2 Adjust the volume of the solution to 1000 mL with reagent water, if the pH is below 5.0 ± 0.2 after 6 hours.

5.10.3 Measure and reduce the pH to 5.0 ± 0.2, if required, after 22 hours and continue the extraction for an additional 2 hours.

5.11 Add enough reagent water at the end of the extraction period so that the total volume of liquid is 1000 mL. Record the amount of acid added and the final pH of the solution.

5.12 Separate the material into its component liquid and solid phases as described under the Separation Procedure, Step 4. Discard the solid portion.

Note: It may be necessary to centrifuge the suspension at high speed before filtration, for leachates containing very fine grained particles.

5.13 Calculate the amount of free liquid from Step 4.12 corresponding to 50 g of the dry solid material. Add this amount to the leachate from Step 5.12.

Note: If the analysis is not performed immediately, store separate aliquots of the leachate at 4°C, after adding appropriate preservatives for the analytical parameters of interest.

5.14 Analyze the combined solutions from Step 5.13 for contaminants listed in Table 1 of this Schedule, that are likely to be present.

5.15 Report concentrations of contaminants in the combined leachate and the free liquid solution as mg/L.

5.16 Carry a blank sample through the entire procedure, using dilute acetic acid at pH 5.0 ± 0.2.

6.0 Structural Integrity Procedure

This procedure may be required prior to extraction for some samples as indicated in Step 5.1. It may be omitted for products or substances with known high structural integrity.

Procedure

6.1 Fill the sample holder with the material to be tested. If the sample of the products or substances is a large monolithic block, cut a portion from the block measuring 3.3 cm in diameter by 7.1 cm in length. For a treated product or substance (e.g. solidified products or substances) samples may be cast in a form with the above dimensions for the purposes of conducting this test. In such cases, the products or substances should be allowed to cure for 30 days prior to further testing.

6.2 Place the sample holder in the structural integrity tester, then raise the hammer to its maximum height and allow it to fall. Repeat this procedure 14 times.

6.3 Remove the material from the sample holder, and proceed to Step 5.2. If the sample has not disintegrated, it may be sectioned; alternatively use the entire sample (after weighing) and a sufficiently large bottle as the extraction vessel. The volume of reagent water to be initially added is 16 mL/g of dry sample weight. The maximum amount of 0.5N acetic acid to be added is 4 mL/g of dry sample weight. The final volume of the leachate should be 20 mL/g of dry sample weight.

TABLE 1

LEACHATE QUALITY CRITERIA

Item	Column I Contaminant	Column II Concentration in Waste Extract (mg/L)
1.	Aldrin + Dieldrin	0.07
2.	Arsenic	5.0
3.	Barium	100.0
4.	Boron	500.00
5.	Cadmium	0.5
6.	Carbaryl / 1-Naphthyl-N-methyl carbamate / Sevin	7.0
7.	Chlordane	0.7
8.	[illegible]	[illegible]
9.	Cyanide	20.0
10.	2,4-D	10.0
11.	DDT	3.0
12.	Diazinon /Phosphordithioic acid, O,O-diethyl O-(2-isopropyl 6-methyl-4-pyrimidinyl) ester	0.02
13.	Endrin	0.02
14.	Fluoride	150.0
15.	Heptachlor + Heptachlor epoxide	0.3
16.	[illegible]	[illegible]
17.	Lindane	0.4
18.	Mercury	0.1
19.	Methoxychlor / 1,1,1-Trichloro-2, 2-bis (p-methoxyphenyl) ethane	10.0
20.	Methyl Parathion	0.7
21.	Nitrate + Nitrite	1000.0
22.	Nitrilotriacetic acid	5.0
23.	Nitrite	100.0
24.	Parathion	3.5
25.	PCBs	0.3
26.	Selenium	1.0
27.	Silver	5.0
28.	Toxaphene	0.5
29.	2,4,5-TP /Silvex/ 2-(2,4,5-Trichlorophenoxy) propionic acid	1.0
30.	Trihalomethanes	35.0
31.	Uranium	2.0

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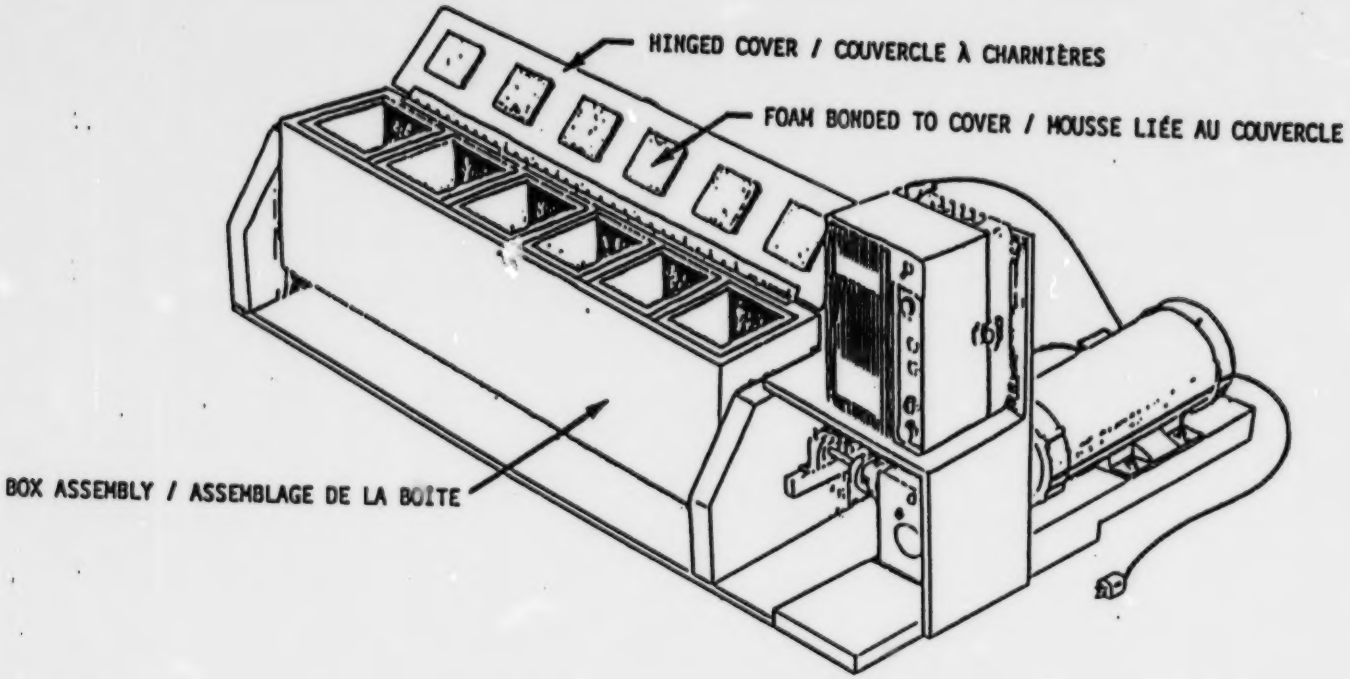
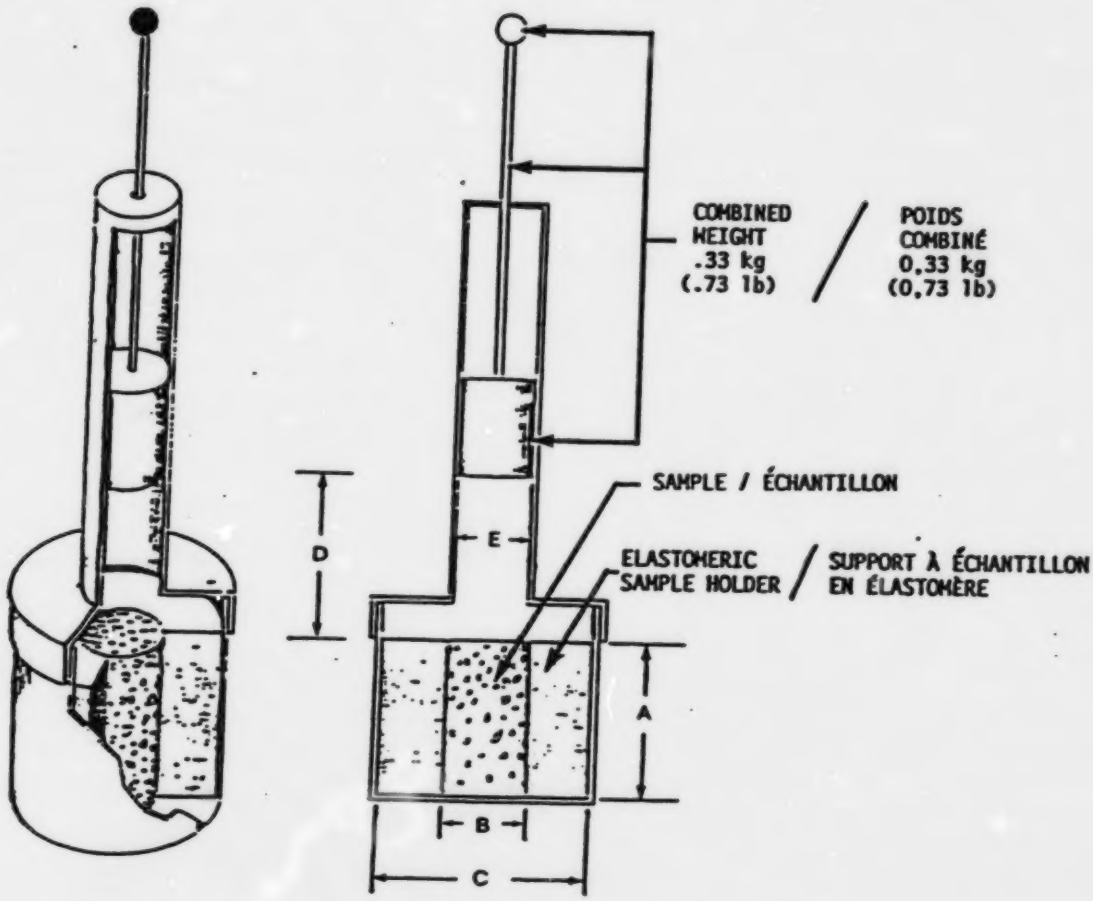


FIGURE 1
SOLID WASTE ROTARY EXTRACTOR /
EXTRACTEUR ROTATIF DE DÉCHETS SOLIDES

L'Imprimeur de la Reine du Manitoba



LEGEND / LÉGENDE

A.	7.11 cm (2.8 ") / 7,11 cm (2,8 po)
B.	3.30 cm (1.3 ") / 3,30 cm (1,3 po)
C.	9.40 cm (3.7 ") / 9,40 cm (3,7 po)
D.	3.18 cm (1.25 ") / 3,18 cm (1,25 po)
E.	15.24 cm (6 ") / 15,24 cm (6 po)

FIGURE 2
STRUCTURAL INTEGRITY TESTER /
APPAREIL D'ESSAI DE LA CONSTITUTION STRUCTURALE

APPENDIX H

SELECTED PESTICIDE LEVELS IN PLASTIC AND CARDBOAD LEACHATES (PPM)

PESTICIDE	CARDBOARD	RINSED PLASTIC	UNRINSED PLASTIC
2,4-D/MCPA	1.0	5.0	51.0
POAST	<1.0	<1.0	
ROUNDUP	<1.0	<1.0	9.0
TREFLAN	<1.0	<1.0	<1.0
AVADEX	<1.0	<1.0	<1.0
HOEGRASS	<1.0	<1.0	<1.0
BANVEL	2.0	1.0	1.0
AVENGE	<1.0	1.0	2.0
BUCTRIL M	<1.0	<1.0	<1.0